UNIVERSITY OF KENTUCKY

Purchasing Division

UK
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Main Campus
Audiovisual Standard
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Table of Contents

1.0 Document Revision History

Version	Change Description	Date	By
0	Draft	01Jan18	MS
1	Various Updates	02Apr18	MS
2	Networking Requirements	10Apr18	MS (CMB)
3	Various Updates	22Nov19	MS (RS)

2.0 Introduction

The purpose of this publication is to ensure that all audiovisual facilities are designed and constructed to the standard as set out by UK Information Technology Services, Audio Visual Design Build (ITS AV).

These guidelines will be used as the standard to which the facilities will be designed or updated over time. In situations where these standards cannot be met, consultation during the design stage, and prior to the commencement of any construction work, with UK Information Technology Services staff must be undertaken.

This publication details the physical, programming and security requirements for the audiovisual equipment to be used in classrooms, meeting rooms, PC labs and lecture auditoriums. UK ITS AV notionally endorses the AVIXA, AV/IT Infrastructure Guidelines for Higher Education as a companion document subject to the specifics of the UK ITS Audio Visual Specifications.

3.0 Definitions

UK ITS or UK ITS AV – UK Information Technology Services, Audio Visual (AV) design staff or authorized representative

ADA – Americans with Disabilities Act

AFF – Above Finished Floor

ANSI – American National Standards Institute

Audio Visual Integrator – Any person or company commissioned by UK to perform work on UK audiovisual systems other than UK ITS AV staff

Dante – Digital Audio Network Through Ethernet is a combination of software, hardware, and network protocols that deliver uncompressed, multi-channel, low-latency digital audio over a standard Ethernet network using Layer 3 IP packets

DSP – Digital Sound Processor

EDID – Extended Display Identification Data is a data structure provided by a digital display to describe its capabilities to a video source (e.g. graphics card or set-top box). This is what enables a modern personal computer to know what kinds of monitors are connected to it

HDBaseT – promoted and advanced by the HDBaseT Alliance, this is a consumer electronic (CE) and commercial connectivity standard for transmission of uncompressed high-definition video (HD), audio, power, home networking, Ethernet, USB, and some control signals, over a common category cable (Cat5e or above) using the same 8P8C modular connectors used by Ethernet

HDCP – High-bandwidth Digital Content Protection is a form of digital copy protection developed by Intel Corporation to prevent copying of digital audio and video content as it travels across connections

HDMI – High-Definition Multimedia Interface is a proprietary audio/video interface for transmitting uncompressed video data and compressed or uncompressed digital audio data from an HDMI-compliant source device, such as a display controller, to a compatible computer monitor, video projector, digital television, or digital audio device

AVIXA (formally known as InfoComm) – Trade association representing the professional audiovisual and information communication industries worldwide

IPBaseT – Internet Protocol based connectivity similar to HDBaseT, but this technology is able to connect devices over gigabit IP networks instead of dedicated connections

NFPA – National Fire Protection Association (National Fire and Electrical Code)

POE – Power over Ethernet

RU – Rack unit equivalent to 1.75 inches of vertical space in an AV rack

SANS – Institute for information security training and information security standards

SDVOE – Software Defined Video Over Ethernet

TIA – Telecommunications Industry Association

4.0 Compliance and References

4.1 Industry standards, guidelines, and best practices (InfoComm):
4.2 INFOCOMM, AV/IT Infrastructure Guidelines for Higher Education
4.3 ANSI/INFOCOMM 1M-2009, Audio Coverage Uniformity in Enclosed Listening Areas

4.4 ANSI/INFOCOMM 2M-2010, Standard Guide for Audiovisual Systems Design and Coordination Process(Project Management process)
4.5 ANSI/INFOCOMM 3M-2011 Projected Image System Contrast Ratio
4.6 ANSI/INFOCOMM 4: 2012 Audiovisual Systems Energy Management
4.7 ANSI/INFOCOMM V202.01:2016, Display Image Size for 2D Content in Audiovisual Systems
4.8 AV Design Reference Manual, from INFOCOMM International.
4.9 Audiovisual System Design and Coordination Components, from INFOCOMM International.

5.0 Physical Requirements for AV Systems

5.1 Equipment Racks

Audio visual equipment is typically mounted in standard 19-inch racks. Racks must be provided with a minimum clearance to the front, rear and one side of 36 inches unless wall mounted. All equipment, where possible, will have rack ears for mounting. If equipment is not suitable for rack mounting a minimum of a 1RU cantilever shelf will be provided to appropriately support each piece of equipment.

Rack design must allow for only a maximum of 75% fill to accommodate future growth. For example, if it is a 10U rack, only 7U may be used for design fill. A suitable number of 120V AC rack mounted power conditioners with power overload switches will be provided as required. Power conditioners will have no more than 80% of load designed; for example, a 15A unit will carry a maximum load of 12A . Load calculations are to be included in with all project designs along with BTU calculations for each rack assembly.

Where racks must be installed in cabinetry, rear access in the form of a lockable door is to be provided. The lock will be the AV standard key. All cabinets and rack barrels will be keyed alike and at least 2 keys for each install will be provided to UK ITS AV.

Where rear access cannot be provided, the cabinet must allow for a sliding rack to be easily mounted for servicing. There must be sufficient width and depth (clear of obstructions such as hinges) for the rack and loop of cables.

Technical furniture with embedded racks: advanced teacher stations, Credenzas, conf tables, etc. To be coordinated and approved by UK ITS AV prior to final design sign-off.

Built in webcam for instructor viewing/recording/etc.

5.2 Lecterns

Lecture benches or lecterns will be reviewed by UK ITS AV.
The audiovisual equipment for the presenter will be determined during the design consultation process. This equipment should be mounted in suitable 19-inch wide racks within the lectern assembly.

To restrict unauthorized access, any lecture bench design will include a lockable enclosed cabinet section and an opened fronted cabinet section. Any lockable section will be keyed alike.

Open sections will typically be included for user accessible playback equipment or PC and will include some form of physical and/or electronic security system. Any equipment located on top of benches must, in consultation with UK ITS AV, include some form of physical and/or electronic security system.

Suitable cable paths throughout a lecture bench will be provided. Final lecture bench design will be determined during the design consultation process. The audiovisual integrator is to provision for external audio visual inputs, such as laptops, which will retract and be hidden away when not required.

All power and network outlets required for connection to the AV equipment must be provided inside the lecture bench cabinet space and should be run out of the wall with the outlets positioned 18 Inches AFF (wherever possible. A cable path should have sufficient capacity to allow for all of the signal cables and future expansion.

5.3 Ventilation

Ventilation, airflow and equipment operating temperature will require consideration when designing the physical layout of the active equipment in the AV rack to prevent unacceptable temperature rise.

Recommended ventilation is an air inlet grill in the front and rear doors and an outlet grill in the cabinet top, mounted to the rear of the compartment. Should an outlet grill in the cabinet top not be possible, in consultation with UK ITS AV, a grill shall be mounted as high as possible on either side of the rack cabinet suitable with provision for an internal fan.

Mechanical devices that contain moving parts, such as fans, that are located at a lectern or close to teaching positions, should be quiet to ensure no distraction is caused to users of the space. Noise should be no louder than 30 dB at 1m from the AV Rack.

Ventilation is required for racks carrying a heat load greater than XXX BTUs. Forced air cooling with filtering via case-mounted fans. Get with MAP on this paragraph.

5.4 Room Layout

The lectern is to be positioned in a suitable location in consultation with UK ITS AV.

To comply with ADA regulations, the final lectern position should provide a gap of 48 to 60 inches between the front wall and the lectern.

See AVIXA (InfoComm), AV/IT Infrastructure Guidelines for Higher Education for recommendations for sightlines, viewing angles, image heights and other critical room design considerations.

AV Integrator must submit room sightline diagram during submittal phase.

Alternative room layouts will be considered where appropriate in consultation with UK ITS AV and as determined during the design consultation process.

5.5 Projection Surfaces

Regarding screen size: screen size shall be in compliance AVIXA V202.01-2016. BDM/ADM.

Single Screen Projection

The data projector images/screens are to be centered as close as possible to the room center line and positioned either flush with ceiling or above the whiteboard assembly as close to the ceiling as possible. This is done to ensure uninterrupted viewing from anywhere in the room. As necessary, the audiovisual contractor is to supply 6 inches off the wall mounting brackets to allow for the screen to drop down in front of wall mounted whiteboards.

Final screen position will be determined during the design consultation process, and any variation to this will not be accepted unless written permission is supplied by UK ITS AV before installation.

Dual Screen Projection

Dual-screen projection will have the projection screens mounted as close as practically either side of the room center line and positioned either flush with ceiling or above the whiteboard assembly as close to the ceiling as possible. This is done to ensure uninterrupted viewing from anywhere in the room. As necessary the Contractor is to supply six inches off the wall mounting brackets to allow for the screen to drop down in front of wall mounted whiteboards.

Final screen position will be determined during the design consultation process, and any variation to this will not be accepted unless written permission is supplied by UK ITS AV before installation.

5.6 Display Devices

All display devices must have a minimum native resolution of 1920x1080 at 60fps (1080p) or 1920x1200 at 60fps (1200p) and an aspect ratio of 16:10. The only exception to this standard would be ultra-short throw projection, which may have a lower resolution of 1280x800.

Display devices must be capable of accepting digital inputs such DVI-D, HDMI and DisplayPort. Certain applications may require interfacing with SDI, this will be at the discretion of UK ITS AV.

All display devices must be compliant with HDCP implementation. At a minimum HDCP compliance shall be version 2.0.

All display devices shall be considered for HDR and full gamma color at the discretion of UK ITS AV and as the application dictates.

Multimedia Projectors

Multimedia projectors will be supplied and installed as specified by UK ITS AV. The projector should be installed at a distance from the screen to ensure the projected image will completely fill the nominated screen with the projector's zoom range at a center setting. UK ITS AV has a preferred range of models of projectors and any variation to this will not be accepted unless written permission is supplied by UK ITS AV before installation.

Multimedia Projector Ceiling Mount

Multimedia projector ceiling mounts must be of a suitable high quality professional grade universal

product. Final choice of bracket will be at the discretion of UK ITS AV. The provided mount should have a white powder coat finish with a locking arm that secures the projector to the base plate. The locking arm should be secured by padlocked or key locking system. Two keys should be provided for any locking mechanism. The projector mounts adjustable settings are to be firmly tightened.

Projector ceiling brackets must be mounted in accordance with the manufacturers' specifications.

Mechanical (projector cages) and electronic security (tamper switches) may also be required. This will be specified during the design consultation process by UK ITS AV.

Flat Panel Displays

Flat Panel Displays shall have a minimum of UHD (3,840 X 2,160 pixels).

All flat panel displays must have a minimum of RS-232 connection capability for control. Manufacturer's bidirectional control protocol must be supplied with the specifications prior to installation. Any alternative flat panel display must be submitted for review to UK ITS AV prior to installation.

Flat panel displays using USB for control is acceptable if the application dictates.

Flat Panel Display Mounts

Flat panel mounts that are mountable on the floor, wall or ceiling must be installed as per the manufacturers' specifications. The flat panel mounts should be of a high quality professional grade product unless alternative is approved by UK ITS AV prior to installation. All mounts shall be rated for 5X the weight of the device it is to support.

Backing for wall mount displays will be minimum 3/4" CDX grade or better plywood in steel stud construction. Lag screws into wood studs or lag shield anchors into solid concrete are approved alternative mounting methods.

Mechanical and electronic security may also be required. This will be specified during the design consultation process by UK ITS AV.

Final product selection and mounting position will be determined during the design consultation process and any variation to this will not be accepted unless written permission is supplied to UK ITS AV prior to installation.

5.7 INTERACTIVE TOUCH EXPERIENCES

5.7.1 Hardware Requirements

5.7.1.1 Touchscreen Display

Projected Capacitive Touch (PCAP) capable of 10+ simultaneous touches.
Brightness shall be based on screen location and appropriately sized for the lighting, both ambient and electric light, of the space. 500 nits minimum.
2X HDMI inputs located on rear of device, no inputs to be located on front or sides.
Screen size as indicated on drawings.
Full HD resolution 1920 x 1080 @ 60Hz
Bezel-less
Built in stereo audio capable of being toggled off if other audio systems are integrated with display.
Function buttons shall be capable of being disabled
Operating Temperature: 32 degrees F to 104 degrees F
Rated for 24 hour/day operation
Display shall be no more than 3" thick and meet all applicable building requirements for protrusion from wall, etc.
Warranty: 3 years.
Manufacturers: ELO, NEC, Planar

5.7.2 Small Form Factor Computer

- Intel Core Processor (i7)
- Intel HD Graphics Processing Unit (GPU)
- HDMI out
- Built-in hardware EDID emulation
- Minimum of 16GB DDR4-2133 RAM
- 802.11ac Wireless
- Bluetooth
- Warranty: 3 years
- Manufacturers: RMG Networks

5.7.3 Installation Requirements

- Mounting Hardware
  - Locking
  - Full motion
  - Device mounting provisions on mount for easy access
- Architectural Details
  - Refer to architectural details for installation conditions.
  - Appropriate wall blocking/support shall be installed prior to installation of mount and display.
- Ventilation requirements
  - All ventilation requirements shall be confirmed prior to installation to avoid premature equipment failure.

5.7.4 Infrastructure Requirements
Pathways
Cabling
Box size/type

5.7.5 Emergency Management – If Required – refer to drawings
Emergency power
UPS
Generator
Content management/ownership

5.7.6 Software Requirements – Content Management System (CMS)
Centralized software managed by UK IT
Content shall be able to be managed from schedules
Control power to devices
Any capital project shall include latest software update and licensing fees associated with system.

5.8 Interactive Way Finding (Kiosks)

5.8.1 Hardware Requirements - Unless Otherwise Noted on Drawings
Touchscreen display – Projected Capacitive Touch (PCAP)
400 nits minimum depending on ambient light levels.
3 HDMI inputs
Full HD resolution min

Small Form Factor Computer

- Intel Core Processor (i7)
- Intel HD Graphics Processing Unit (GPU)
- HDMI out
- Built-in hardware EDID emulation
- Minimum of 16GB DDR4-2133 RAM
- 802.11ac Wireless
- Bluetooth
- Warranty: 3 years
- Manufacturers: iBase, Intel, Dell

Installation Requirements
Mounts
Architectural details
Ventilation requirements

5.8.2 Infrastructure Requirements
Pathways

Cabling
Box size/type

5.8.3 Emergency Management
UPS
Content management/ownership

5.8.4 Software Requirements – Content Management System (CMS)
Centralized software managed by UK IT
Content shall be able to be managed from schedules
Control power to devices
Any capital project shall include latest software update and licensing fees associated with system.

5.9 Digital Signage

5.9.1 Hardware Requirements
5.9.1.1 Touchscreen display – Projected Capacitive Touch (PCAP)
5.9.1.2 Small Form Factor Computer – To be coordinated with UK ITS.

5.9.2 Software Requirements – Content Management System (CMS)
Centralized software managed by UK ITS
Content shall be able to be managed from schedules
Control power to devices
Any capital project shall include latest software update and licensing fees associated with system.
Coordinate software requirements with UK ITS.

5.10 AV Control and Switching

AV Control

UK ITS AV control equipment in complex control environments is exclusively Extron unless otherwise specified by UK ITS AV. If a design requires a control product that is not able to be supplied by Extron, the recommended variation will not be accepted unless written permission with relevant data sheet is supplied to UK ITS AV before the design is approved and installation can begin.

AV Switching

The University utilizes Extron switching equipment for typical spaces. Any space that has been designated to be converted from analog to digital, or any space that is designated to be configured to output High Definition, will require the use of a High Definition Digital HDMI switcher/matrix. The switcher will be capable of at least:

1. HDCP compliance with full key management on all inputs and outputs.
2. EDID management
3. Scaling/frame rate conversion
4. HDMI Audio embedding and de-embedding
5. 1920x1200@60Hz
6. Color space management

Any variations, such as for spaces that require more switching capability that can be provided through a listed solution, must be approved by UK ITS AV before the design is approved and installation can begin.

5.11 Audio

Each piece of audio system equipment, including program playback equipment and speech reinforcement equipment (or a combination of both) must be be specified per space in consultation with UK ITS AV during the design process.

Special attention should be given to any speech reinforcement system. This system will be independently designed for each individual space. As a baseline standard, system capable of program playback and speech reinforcement will consist of suitable front of house low impedance speakers supplemented with delay flush mounted ceiling speakers that are suitably positioned throughout the space. The system shall adhere to a minimum 25db acoustic S/N. Final size and position of all speakers must be determined in consultation with UK ITS AV during the design process.

Wall-mounted speaker brackets allow speaker adjustment both horizontally and vertically and allow the speaker to be physically locked into position. Ceiling speakers will be securely mounted to ceilings and additional support will be provided across ceiling t-bar rails as required.

The number and style of microphones (hardwired or radio), audio processing/mixers including digital sound processors (DSP) and amplifiers will be at the discretion of UK ITS AV.

The audio in each space will need to be individually tuned to maximize the audio.

All unbalanced audio signals to be run greater than 6 feet must be converted to a balanced audio signal.

Unbalanced line-level runs will only be accepted in consultation with UK ITS AV. All microphone cable must be run fully balanced XLR without exception.

NOTE: Special consideration should be given to any venue which may include video conferencing equipment.

5.12 Source Equipment

All playback, Apple and PC based source equipment will be individually specified for each space in consultation with UK ITS AV during the design process. Typically these units are readily and easily accessible to all users and may require additional mechanical or electronic security measures as deemed suitable by UK ITS AV.

5.13 Video Conferencing

UK ITS AV has identified several key aspects that are required for the design of all video conferencing facilities within the University. These design requirements are based on the technical aspects of video conferencing system and the room environment.

A high quality omnidirectional table microphone equipped with a shock mount is the standard. In rooms where a table microphone is not suitable, ceiling microphones may be used. Special care must be taken to keep them physically separated from air conditioning outlets, lighting fixtures and existing cameras.

The lighting in all video conference spaces will require special consideration and design to ensure a high quality image from the camera. Every effort should be made to remove or restrict any light bleeding into the room from windows, glass doors/wall, etc. Blackout curtains or blinds are to be used but will require consultation with UK ITS AV during the design process.

Additional consideration to ensure a positive video conference experience includes the type of video conferencing system, display size, camera position, furniture design, color selections, room size, signage (including UK branding), etc.

Web Based Collaboration Solution

Dedicated hardware is required in teaching spaces or meeting rooms which offer web collaboration such as **WebEx, Cisco Jabber, and Zoom** to ensure a good user experience.

For small meeting rooms and teaching spaces that seat no more than 12 people a USB webcam and echo cancelling speakerphone is recommended. The following equipment is recommended by UK ITS:
Video: PTZ web camera (Audio: AMZ Alero (includes a digital sound processor (DSP) with acoustic echo canceling (AEC)
For medium to large meeting rooms and teaching spaces a dedicated DSP with AEC should be used along with high quality speakers and high quality microphones. Speakers and microphones should provide enough coverage so both parties can hear each other clearly with no echo.

For video a high quality high definition pan tilt zoom camera should be used so participants can be seen clearly at the far end.

5.14 Lighting

If lighting control is required, a provision that provides the ability to control the house and stage lighting dimmers will be coordinated with the AV control system. Integration into existing lighting systems will be determined during the design process by UK ITS AV.

5.15 Lecture Capture

Lecture capture facilities are required in many of the University's teaching spaces. Additional video and audio feeds to lecture capture equipment must be as determined during the design consultation process by UK ITS AV.

5.16 External AV Input Plates

Suitable AV input plates will be specified by UK ITS AV. The Contractor may supply an alternative manufacturer with prior approval from UK ITS AV. All plates specified must be engraved with black text.

5.17 Network and Security Infrastructure Requirements

IP networking between AV systems may be accomplished in one of two manners

- **Air Gapped Installation** – In this scenario AV equipment is not connected to a UK managed network. All IP networking is the responsibility of installer

and / or end user. No equipment may receive an uplink or data connection from the UK network, and no device may be dual-homed to both the AV network and the UK network. As such, the AV network is completely isolated and cannot communicate with any other device connected to the UK network. Equipment selection used to interconnect devices in this scenario may be selected at the discretion of the installer, vendor, or end user. Equipment installation must be completed in accordance with all applicable ITS standards.

- **ITS Managed** – In this scenario ITS Networking & Infrastructure will be responsible for the design, procurement, installation, management, and maintenance life-cycle of an IP network to support AV systems. Prior to purchase or installation ITS Networking & Infrastructure must provide approval for any net-new system being installed and connected to this network. ITS shall:
    - Select network equipment based an appropriate enterprise standards and compatibility.
        - Efforts should be made to ensure that any and all connections to the UK network are made within an Intermediate Distribution Frame (IDF).
        - Should conditions exist which dictate that connections be made outside of an IDF, an appropriate ITS managed network device must be installed (per enterprise standards) at an agreed upon location in order to accommodate these connections. Appropriate rack, power, and environmental conditions must exist within that location (typically a podium or credenza type installation) to accommodate switch gear and UPS equipment. A requirement may exist for either fiver or copper uplinks from this location, and will be dependent on a design for each location.
        - Hubs or unmanaged layer 2 switches may not be used to “split” an existing network connection or uplink into multiple connections.
    - Provision all unicast and multicast address
        - The size of broadcast domains will be at the sole discretion of ITS, and no application should assume that Layer 2 adjacency shall exist between any 2 application components.
        - All components must be capable of obtaining a unicast IP address via Dynamic Host Configuration Protocol (DHCP). Should a host require a “static” IP address assignment, that assignment will be accommodated via a DHCP reservation

and should not be hard-coded. A DHCP reservation should not be needed for every device, only those devices which offer services consumed by other clients may require a DHCP reservation. This addressing will be provisioned out of RFC 1918 address space. Any needs for non-RFC 1918 addressing must be discussed and agreed upon prior to purchase and / or implementation.

- All multicast addressing assignments will be made and documented by ITS. These assignments will be made out of the RFC 2365 administratively scoped address block range. Applications must be capable of configuration that allows for the uses of ITS provisioned multicast addressing, and no other multicast address should be used unless it is part of an IANA defined multicast address scope for a specific and appropriate use.

- Be responsible for the security of systems attached to the enterprise network. At a minimum these devices will be located behind the enterprise firewall. Should additional segmentation be required or desired, it is incumbent on the customer, integrator, installer or end-user to request a design which meets these needs.
- Provide written approval of AV design based on submitted designs and equipment specifications.

Registration of devices will be managed through UK ITS. All devices when deployed will have the latest available firmware installed and documented along with serial numbers and MAC addresses of each installed device.

The use of IPBaseT or Network audio design protocols may be considered if the necessary infrastructure is in place and is pre-approved by UK ITS.

Devices that require POE need to be identified along with requirements and specific location. A power management plan for POE devices should be included.

5.18 Audiovisual Systems Cabling Installation Specifications

Cabling

- All cabling must be neat and secure. Where equipment is mounted on slides, sufficient cable length must be provided to enable the item to be withdrawn to the limit of the slides while remaining fully operational and without stress on cables or connectors. Typically cables terminating at the equipment racks or lecterns will have 15ft tails provided.

- Attention must be given to plenum rated installation to make sure the proper cable type is used such as riser rated vs plenum rated. Contractor is responsible for verifying the installation requirements.
- Velcro must be used to secure cabling at racks for the looms and cable ties may only be used to secure the termination point to the equipment. Cables terminating at the equipment, i.e. data projectors, speakers etc. must have 6ft tails provided.
- Any in-ceiling cabling must be suspended above ceiling tiles on J-hooks or cable tray.
- At least one pull string must be run from the AV rack to the ceiling space.
- All connections must be to industry standard. Connectors terminated on site are to be of a high quality and professional standard.

Cable Labeling
AV Integrator shall followAVIXA cable labeling standard ANSI/AVIXA F501.01

Audio Visual Cable specifications
The following cable are considered acceptable for UK audiovisual installations for in room use only.
Substitutes or any non-specified cable types must be approved before installation by submitting data sheets to UK ITS AV.

Type	**Description**	**Manufacturer**
HDMI Passive	HDMI 2.0 Rated – Minimum Maximum acceptable length is 50 feet.	
HDMI Composite Fiber Hybrid	HDMI 2.0 Rated – Minimum; active optical cable. Maximum acceptable length is 100 feet.	
HDMI Fiber Connection	HDMI 2.0 Rated – Minimum; pure fiber single mode OR multi mode. Length limitations per fiber performance requirements.	

Audio	Speaker cable 12-2 thru 18-2	
USB3.0	Thunderbolt	
USB type C	Type C connections must imploy e-marker chips and billboard chips.	
Data	Per UK ITS requirements	

Network Cable Specifications

For all UK CNS Network cabling standards, please refer to their design guidelines for Division 27 at http://www.uky.edu/cpmd/design-standards

5.19 ADA Compliance and Integration

Hearing Augmentation
The audiovisual integrator must supply and install an under floor induction loop with low spill design to ensure there is no audio audible in adjacent spaces. Where there is danger of spill into adjacent rooms, above or below, an ultra-low spill phased array loop must be provided. In the situation where an under floor solution is not possible an FM or IR solution must be installed.

The supply and installation of any hearing augmentation system into a teaching space is to comply strictly with the following:

1. ADA Standards for Accessible Design
2. Infra-Red receivers with a minimum of 95% coverage
3. 1 IR receiver for every 25 persons up to 500 persons
4. Test results for audit purposes that the installed system meets or exceeds the current standards

Mounting Heights for Visually Interactive Devices
Acceptable height of 54-inches is allowed if it is side approachable, otherwise the maximum height of 48 inches applies.

5.20 System Programming

Manufacturer Specific
Crestron Programming
Crestron programming is to be provided to allow for easy and logical user system operation.

The touch panel layout and graphics/font is to resemble the format displayed in the following example:

Please note that a warm-up and cool-down popup page must be displayed when a lamped projector is being turned on and off. This popup displays progress in terms of a % count and progress bar graph. All system user interfaces must be approved by UK and adhere to UK-supplied template.

Refer to Appendix for more information.

Hardware Administrative Rights

All hardware will be programmed with UK having full administrative rights to all system components.

AV Integrator Programming Bidder Qualifications

Any audio visual integrator providing quotation for any specified system must meet the following criteria in regards to the product supply and programming:

1. Must be a certified dealer of the respective products, recognized by the manufacturer.
2. Must have at least one in-house certified programmer within the organization. The audio visual integrator is to provide programmers details with suitable reference to past projects completed and training/certification obtained.
3. Must provide references of previously completed audio visual projects incorporating integrated control systems. It is required that at least two references have accompanying contact details for the University to check upon customer satisfaction.

5.21 Audiovisual System Installation Process

General Guidelines

The audiovisual integrator is to install all equipment for the teaching space audio visual system as outlined throughout this scope of works/specification and University provided system block line diagram.

All works are to be completed to a high standard with a fully functioning audio visual system handed over at completion of the project:

1. In accordance with AV industry best practices, all mounting hardware will be a minimum Grade 5 hardware. All load calculations will use a minimum 5x safety factor so that each fastener can carry the load of the object by itself plus the redundant anchors. Utilize fasteners that are rated for overhead use where appropriate. Prior to installation, all anchors shall have their specifications sheets approved by the project structural engineer.
2. UK ITS AV will supply all network connections in the form of a POE port.
3. Audio is to be free of any buzz, hum and any other undesired noise. Exact speaker positions are to be based on a practical determination of best sound coverage from the front of house (key decision factors being careful consideration of room layout, possible sound obstructions, and dispersion properties of speakers).
4. Video/Data projection is to be free of any hum bars, shimmer, flicker, ghosting, or any other undesired artifacts, up to the native input resolution of the projection device.
5. Installed plates, controller, screen, duct or conduit, speaker brackets, projector bracket and wall equipment cabinet are all to be installed square, flush and level. The mounting screws/washers/bolts used to fix a specific item are all to be a minimum Grade 5 or better and be matching for that specific item type.
6. Audio visual integrator provided ceiling cutouts for a projector ceiling mount pole are to be neatly cut out with a diameter no greater than 0.25inch of that of the pole itself.
7. Equipment racks - refer to 5.1.
8. In consultation with UK ITS AV, provide adequate power to the projector, lectern and projection screen. A standard ceiling mounted duplex receptacle is to be provided at the projector with a quadruplex receptacle provided to the cabled end of the projection screen (ideally within ceiling cavity where possible) and two quadruplex receptacles to the lectern. All circuits must be linked to a common earth. All electrical works must be provided by a licensed electrician and completed to NFPA 70 and any other relevant Codes. Final number of power outlets to be determined during the design consultation process.

Commissioning

The audiovisual integrator must provide the University with a commissioning schedule/program before commencement of the project. This schedule will be approved by the University before the contractor fully commissions the system/systems. All necessary equipment used by the audio visual integrator to competently test and commission the system is to be outlined in its provided commissioning

schedule/program. For example, it would be expected that video signals would be tested/commissioned using a color bar graph generator at a minimum for that signal type.

Inspection and Testing
The University may throughout an installation inspect and undertake QA assessment of the works performed. Any inspection will be arranged prior and in consultation with the audiovisual integrator and will not interfere with works being carried out on site.
Following practical completion of the works the audio visual integrator must perform a full system test of all supplied equipment, operating functions and connectivity in the presence of UK ITS AV as part of system handover. This will be assisted by ITS AV by providing a detailed checklist to follow. Part of this testing and commissioning phase, ITS AV will also conduct a detailed test of the system that will be documented into a defect, issues and improvements checklist to be followed up within 5 days of handover to the integrator.

Operator Training
The audiovisual integrator must provide a structured training session for UK ITS AV on system operation. This training session is to take place at the final handover stage of the project. Number of hours involved will vary depending on the project and will be agreed to prior to the commencement of any installation.

Project Documentation

Shall comply with ANSI/AVIXA 2M-2010

A project folder is be provided by the audiovisual integrator at handover. The project folder is to contain (where applicable):

Section 1: A complete easy reference list of service contact details for each supplied equipment component in the system. This list is to also include service contact details for the audio visual integrator (standard working hours and out of hours service contacts).

Section 2: All equipment manuals, software and warranty details provided from the Manufacturer.

Section 3: A copy of the ‘As Built’ system block line diagram. In most cases, this will be a simple copy of what the University has already provided the audio visual integrator, unless changes have been made to the standardized system design during the project with authorization from the University in writing.

Section 4: A complete unprotected and un-compiled copy of the control system program is to be supplied on a USB memory stick or CD/DVD ROM. Please note that all separate equipment control modules used within the program are to be provided in a separate file folder titled 'Modules'. All TP Design touch panel design files will be provided in a separate file folder titled 'Touch Panel'.

Section 5: A complete list of supplied equipment with reference to what room each item is located in. The list will include item make, model, description, serial number, MAC address and IP address.

Section 6: Hearing Aid Loop / IR design and design certification.

Design and Review Services:

Michael Stewart, with CMTA has been a part of the UK Audiovisual standardization since its inception. As the original design team UK ITS encourages projects to utilize CMTA services to design, review and follow the installation process from start to finish working along with the installation integrators for coordination of the design and to enforce compliance with the UK Audiovisual Standards. Contact Michael Stewart, mstewart@cmta.com of CMTA, Inc. for additional technical information concerning the campus design. 502-472-9559. www.cmta.com

5.22 Warranty, Service and Support

All equipment supplied under the audiovisual contract must be guaranteed free of defects in hardware and software arising from faults in materials or poor workmanship/programming for at least 12 months from the date of practical completion of the works covered in the contract or agreement.

This warranty must cover a guaranteed faulty equipment service call out response time of 24 hours (within the working week). All reasonable efforts must be made by the audiovisual integrator to have faulty equipment repaired and returned to the University within 5 working days. As part of a faulty component service call out, the audiovisual integrator is required to temporarily install a University provided replacement to any faulty component, ensuring possible teaching space audiovisual system down time is kept to an absolute minimum.

The audiovisual integrator will be responsible for all labor cost and transportation of equipment cost within 100 miles of the UK Campus during the 12 month warranty period.

A complete list of equipment serial numbers and MAC addresses installed into each teaching space is to be provided in required documentation at the time of project handover.

Additional Documentation

This document should be used as a minimum general reference guide for any AV installation within UK ITS AV. As part of any project UK ITS AV may include additional documentation including an audio visual system block line diagram. The audiovisual integrator is to use this diagram in conjunction with the scope of works/specification for system configuration reference and instruction. Any variation to this system design and format will not be accepted without prior written consent from the University's authorized delegate.

6.0 Appendix

6.1 Reference Diagrams

Analytical Decision Making (ADM) Calculation: Screen Height = (Vertical Image Resolution x Distance to furthest viewer / 3438						
Distance to furthest viewer	**Height**		**Width**		**Diagonal**	
(feet)	**(inches)**	**(feet)**	**(inches)**	**(feet)**	**(inches)**	**(feet)**
6	23	1.9	40	3.3	46	3.8
8	30	2.5	53	4.4	61	5.1
10	38	3.1	67	5.6	77	6.4
12	45	3.8	80	6.7	92	7.7
14	53	4.4	93	7.8	107	8.9
16	60	5.0	107	8.9	123	10.2
18	68	5.7	120	10.0	138	11.5
20	75	6.3	133	11.1	153	12.8
24	90	7.5	160	**13.3**	**184**	15.3
28	106	8.8	187	**15.6**	**215**	17.9
32	121	10.1	214	**17.8**	**245**	20.4
36	136	11.3	240	**20.0**	**276**	23.0
40	151	12.6	267	22.2	307	25.5
44	166	13.8	294	24.5	337	28.1

University of Kentucky Classroom Technology Installation Checklist

Building & Room number: _____

Technician Name: _____

Date: _____

Control Interface:

Brand , Model / Serial No.: _____

Test for image/ L&R audio on all sources: _____

Does this control projection screen properly? _____

Projector and/or Monitor(s):

Brand / Model / Serial No.: _____

Mount (Wall / Ceiling): _____

Data connection/IP information: _____

Test for image/ L&R audio on all sources: _____

Computer(s):

Brand / Model / Serial No.: _____

Test for image and L&R audio: _____

Wired and/or Wireless Network: _____

Data connection/IP information: _____

Document Camera(s):

Brand / Model / Serial No.: _____

Test for image color/brightness (all lamps): _____

HDMI / Laptop / Auxiliary input(s):

Test for image and L&R audio: _____

_____

PA / Sound System:

Brand / Model / Serial No.: _____

Microphone(s): _____

Speaker(s) wall/ceiling: _____

Identification numbers (UK property tag, other) : _____

Test all inputs for audio: _____

Projection Screen(s):

Brand / Model / Serial No.: _____

Format: 16:9 4:3 4:4 Size: _____

Mount (Wall / Ceiling / Recessed): _____

Test for interface control (or manual operation): _____

(*Screen should activate with interface power on = screen down, power off = screen up. Control switch should work regardless of interface status.)*

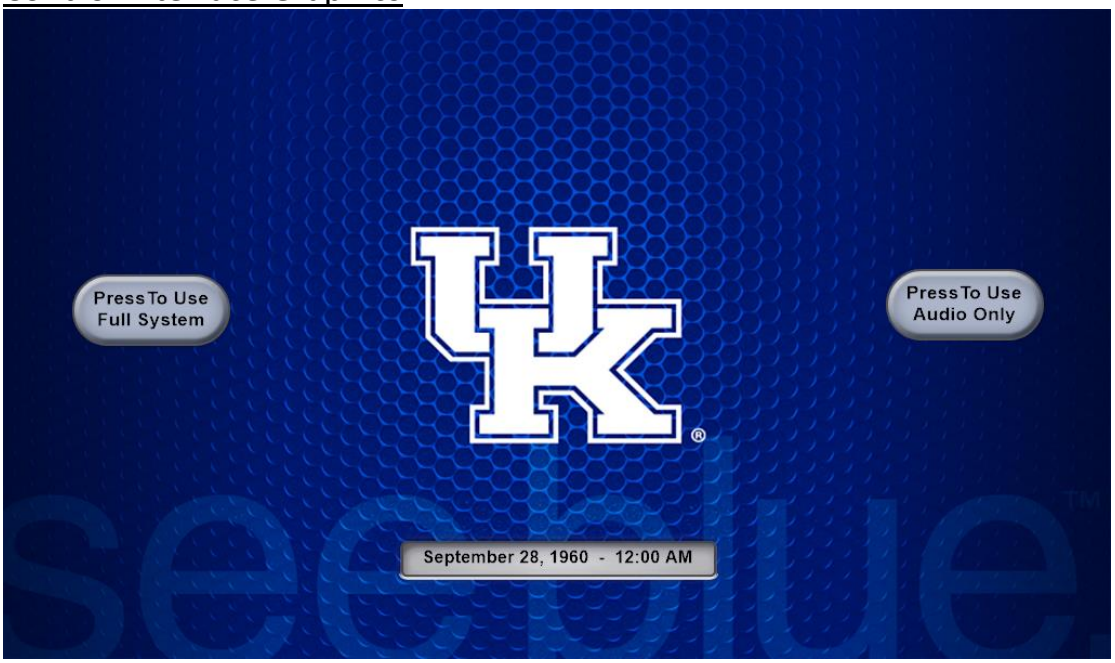
Instructor Lectern(s):

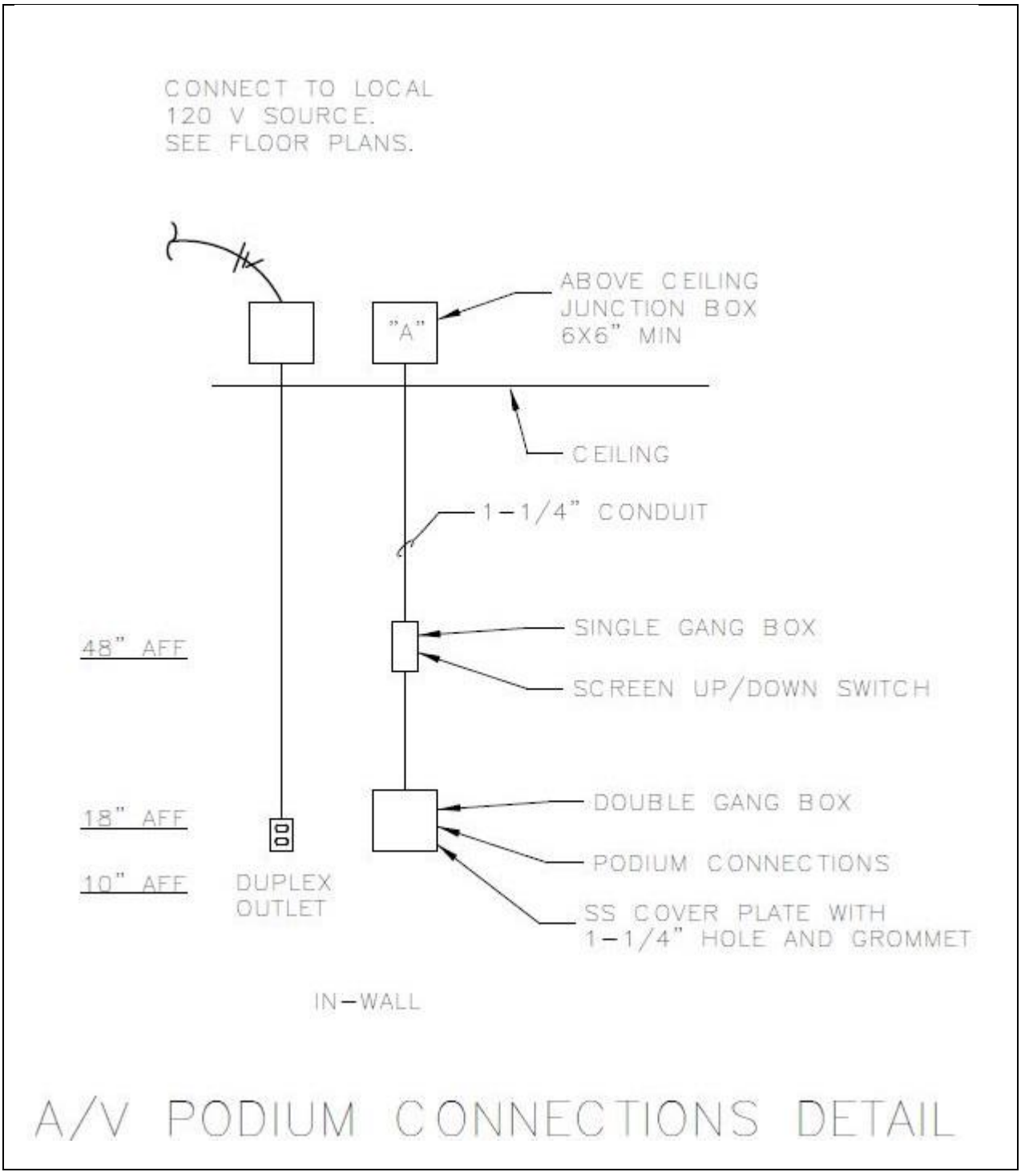
Brand / Model / Serial No.: _____

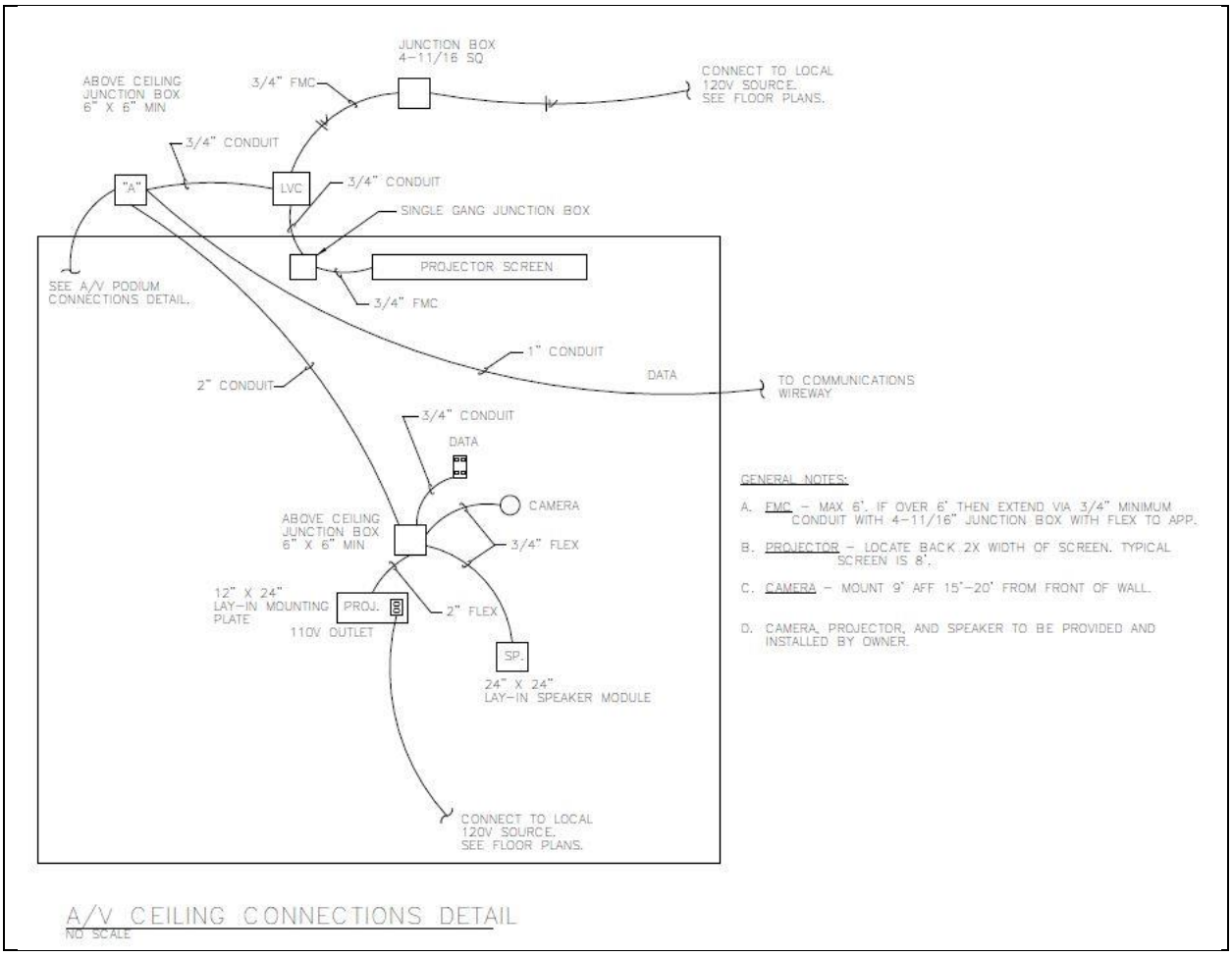
Test for ADA functionality : _____

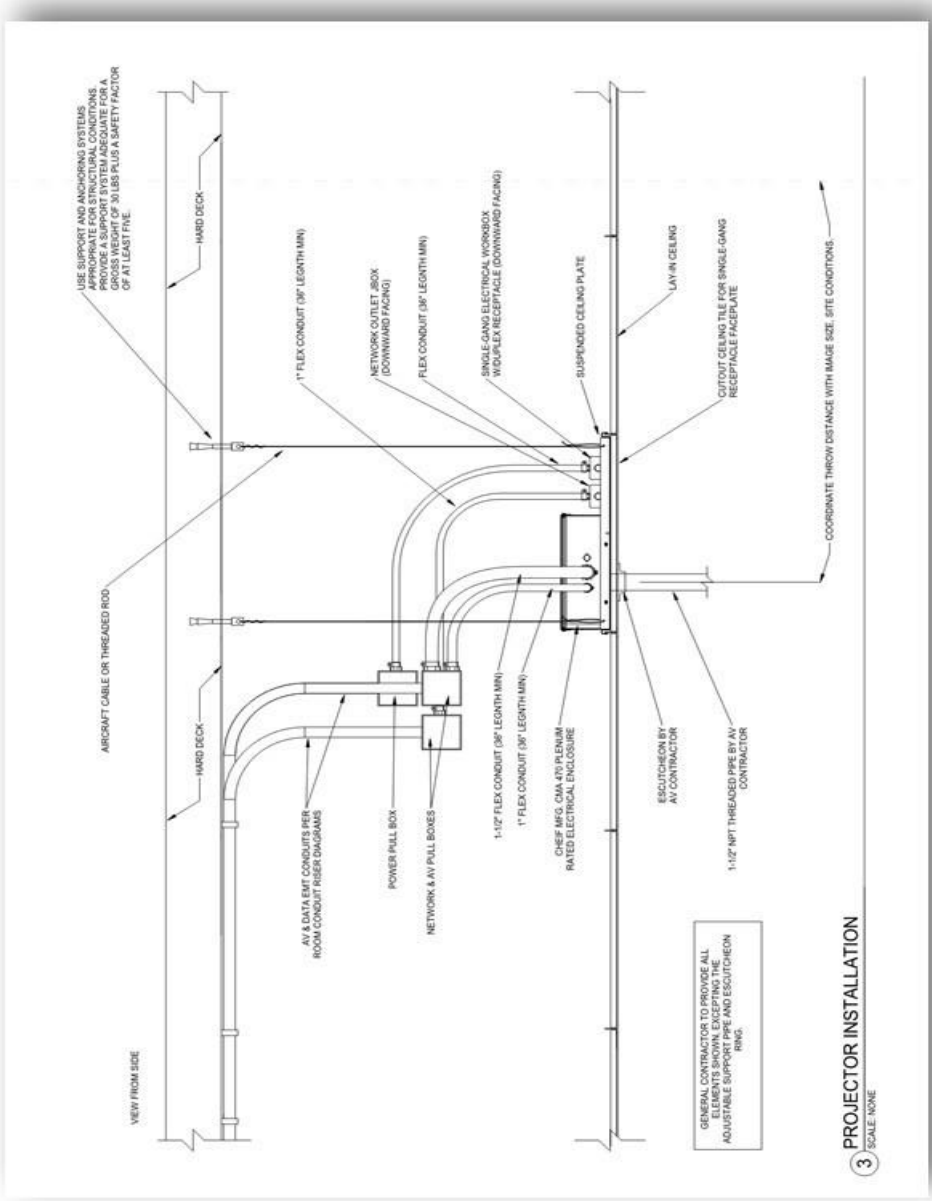
Other Equipment:

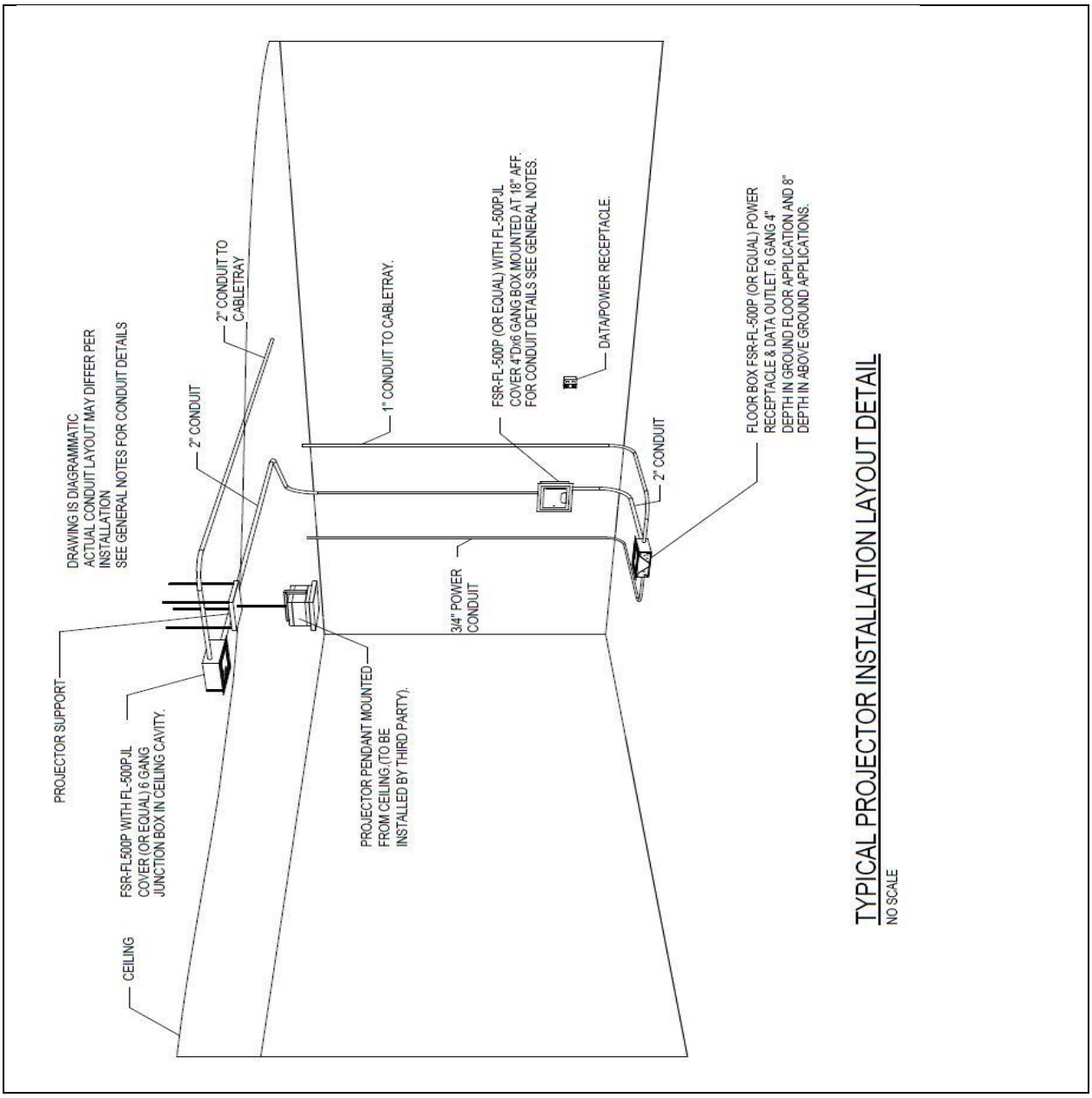
Control Interface Graphics




CONNECT TO LOCAL
120 V SOURCE.
SEE FLOOR PLANS.
"A"
ABOVE CEILING
JUNCTION BOX
6X6" MIN
CEILING
1-1/4" CONDUIT
48" AFF
SINGLE GANG BOX
SCREEN UP/DOWN SWITCH
18" AFF
DOUBLE GANG BOX
PODIUM CONNECTIONS
10" AFF
DUPLEX
OUTLET
SS COVER PLATE WITH
1-1/4" HOLE AND GROMMET
IN-WALL
A/V PODIUM CONNECTIONS DETAIL


JUNCTION BOX
4-11/16 SQ
ABOVE CEILING
JUNCTION BOX
6" X 6" MIN
3/4" FMC
CONNECT TO LOCAL
120V SOURCE.
SEE FLOOR PLANS.
3/4" CONDUIT
"A"
LVC
3/4" CONDUIT
SINGLE GANG JUNCTION BOX
PROJECTOR SCREEN
SEE A/V PODIUM
CONNECTIONS DETAIL.
3/4" FMC
1" CONDUIT
DATA
TO COMMUNICATIONS
WIREWAY
2" CONDUIT
3/4" CONDUIT
DATA
CAMERA
ABOVE CEILING
JUNCTION BOX
6" X 6" MIN
3/4" FLEX
12" X 24"
LAY-IN MOUNTING
PLATE
PROJ.
2" FLEX
110V OUTLET
SP.
24" X 24"
LAY-IN SPEAKER MODULE
CONNECT TO LOCAL
120V SOURCE.
SEE FLOOR PLANS.
GENERAL NOTES:
A. FMC - MAX 6'. IF OVER 6' THEN EXTEND VIA 3/4" MINIMUM CONDUIT WITH 4-11/16" JUNCTION BOX WITH FLEX TO APP.
B. PROJECTOR - LOCATE BACK 2X WIDTH OF SCREEN. TYPICAL SCREEN IS 8'.
C. CAMERA - MOUNT 9' AFF 15'-20' FROM FRONT OF WALL.
D. CAMERA, PROJECTOR, AND SPEAKER TO BE PROVIDED AND INSTALLED BY OWNER.
A/V CEILING CONNECTIONS DETAIL
NO SCALE


USE SUPPORT AND ANCHORING SYSTEMS APPROPRIATE FOR STRUCTURAL CONDITIONS. PROVIDE A SUPPORT SYSTEM ADEQUATE FOR A GROSS WEIGHT OF 30 LBS PLUS A SAFETY FACTOR OF AT LEAST FIVE
HARD DECK
1" FLEX CONDUIT (36" LEGNTH MIN)
NETWORK OUTLET JBOX (DOWNWARD FACING)
FLEX CONDUIT (36" LEGNTH MIN)
SINGLE-GANG ELECTRICAL WORKBOX W/DUPLEX RECEPTACLE (DOWNWARD FACING)
SUSPENDED CEILING PLATE
LAY-IN CEILING
CUTOUT CEILING TILE FOR SINGLE-GANG RECEPTACLE FACEPLATE
COORDINATE THROW DISTANCE WITH IMAGE SIZE, SITE CONDITIONS.
AIRCRAFT CABLE OR THREADED ROD
HARD DECK
AV & DATA EMT CONDUITS PER ROOM CONDUIT RISER DIAGRAMS
POWER PULL BOX
NETWORK & AV PULL BOXES
1-1/2" FLEX CONDUIT (36" LEGNTH MIN)
1" FLEX CONDUIT (36" LEGNTH MIN)
CHIEF MFG. CMA 470 PLENUM RATED ELECTRICAL ENCLOSURE
ESCUTCHEON BY AV CONTRACTOR
1-1/2" NPT THREADED PIPE BY AV CONTRACTOR
GENERAL CONTRACTOR TO PROVIDE ALL ELEMENTS SHOWN, EXCEPTING THE ADJUSTABLE SUPPORT PIPE AND ESCUTCHEON RING.
VIEW FROM SIDE
3 PROJECTOR INSTALLATION
SCALE: NONE



6.2 Recommended Hardware List

ITS AVS - Recommended Hardware List

Control Interface for AV/Technology control in-room

Manufacturer	Model #	Description
Extron	TLP Pro 1220TG	Twelve inch touch screen. Primary control interface manufacturer throughout campus classroom spaces. Dependent on planned functionality of the space. We have more staff trained in Extron programming and trouble-shooting capabilities.
Extron	EBP 200	Primary control interface manufacturer throughout campus classroom spaces. Dependent on planned functionality of the space. We have more staff trained in Extron programming and trouble-shooting capabilities.
Extron	TLP Pro 1520TG	Fifteen inch touch screen. Primary control interface manufacturer throughout campus classroom spaces. Dependent on planned functionality of the space. We have more staff trained in Extron programming and trouble-shooting capabilities.
Crestron		Secondary control interface preference for in-room AV control. Fewer items deployed throughout campus.

Room Scheduling Display Panels

Manufacturer	Model #	Description
Crestron	TSS-752-B-S	Primary solution for Room Scheduling Display Panels

Display Monitor - size may vary depending on the location and primary function of display/signage

Manufacturer	Model #	Description
NEC		Used for presentation connectivity as well as static image digital signage
eLo		Interactive touch signage kiosks or displays.
Samsung	DM55E	alternate model currently in use throughout campus
ViewSonic	CDP4260-TL	alternate model currently in use throughout campus

Display Projector - size/model vary dependent on location size and proposed function of space

Manufacturer	Model #	Description

Sony	VPL-PHZ10	5,000 lumens WUXGA laser light source projector
Sony	VPL-FHZ700L/W	7,000 lumens WUXGA, 1920x1200 native resolution
Epson	Pro L1200U	Laser WUXGA 3LCD projector with 4K Enhancement
Epson	PowerLite 5530U	3LCD technology, 1920 x WUXGA, 5500 lumens

Projection Screen - size/model vary dependent on location size and proposed function of space

Manufacturer	**Model #**	**Description**
DaLite	Room Size dependent	Projection Screen
Draper	Room size dependent	Projection Screen

Document Camera

Manufacturer	**Model #**	**Description**
Lumens	DC193	Document Camera

Video Camera

Manufacturer	**Model #**	**Description**
Sony	SNC-VM601	Video camera for lecture capture
Sony		Video camera for video conferencing
Vaddio		

Wireless computer display video connection

Manufacturer	**Model #**	**Description**
Extron	ShareLink	Wireless display connectivity device
Mersive	Solstice	
AirServer		Wireless display connectivity device

Audio

Manufacturer	Model #	Description
Pure Resonance Audio	SD4	Super Dispersion Ceiling Speaker Array, Built-in 8 Ohm/70 Volt
Shure	MX396/C-TRI	Boundary Microphone for Videoconferencing with PTZ camera integration projects
Shure	MX393/O	Boundary Microphone
Shure	QLXD14/93	Wireless body pack microphone system
Shure	ULX	Courtrooms
Shure	QLXD2/SM58	Wireless Handheld microphone system
BiAmp		Beam tracking for video conferencing / conference rooms
QSC	Ceiling mic	

Installation Hardware / Furniture

Manufacturer	Model #	Description
Chief	CMS445	Suspended Ceiling Tile Replacement Kit - projector mounting
Chief	VCMU	Projector mount
Chief	PAC 252/526	In-Wall Accessory Boxes
Middle Atlantic	ERK-1828	Equipment Rack to include fan and power as needed with PVFD and Vented Rear Door, as well as rear rack rails and rubber feet
		Projection lift for ceiling heights of 12’ or more
Spectrum		Instructor podium/lectern
Marshall		Spec and model to be determined
KI	2VT-LX-C48-30-BLK	ADA adjustable work surface / instructor podium